Two-Stage Bone Expansion Technique Using Spear-Shaped Implants Associated With Overlapped Flap: A Case Report

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The conventional method of ridge expansion uses a mucoperiosteal flap elevation to allow bone corticotomy, which is followed by bone expansion performed with chisels and bone expanders. To facilitate corticotomy and avoid flap elevation, bone expansion can be performed in 2 stages. This case report presents a modified 2-stage bone expansion technique to achieve better implant stabilization and wound closure. This modified approach may be an efficient procedure for minimizing complications.

Key Words: ridge expansion, two stages surgical procedure, narrow pointed implants

INTRODUCTION

fter the loss of a tooth, the alveolar resorption process begins, which reduces bone volume and could make it difficult to place implants.\textsuperscript{1,2} Several procedures have been developed for increasing bone volume to overcome these anatomic obstacles. Among these procedures, the use of block bone grafts, guided bone regeneration, osteogenic distraction, and bone expansion with corticotomy (BEC) can be performed.\textsuperscript{3}

In BEC, a complete flap is raised so that horizontal and vertical osteotomies can be performed. Horizontal osteotomy is performed in the center of the ridge in the mesiodistal direction and vertical osteotomies via the vestibular approach, mesially and distally to the areas where the implants will be placed. After the osteotomies, the bone is expanded by means of greenstick fracture, which is accomplished by introducing chisels and expanders in the osteotomy performed in the center of the ridge. After expansion, a gap forms between the vestibular and lingual bone plates in which one or more implants are immediately placed. The space between the plates is filled with a blood coagulum, presenting a repair process very similar to that which occurs in immediate implants.\textsuperscript{4}

The BEC presents very drastic technical problems that may make the procedure difficult or even unfeasible. The first and most severe is that at the moment of expansion or implant placement, instead of a greenstick fracture occurring, the bone plates and their bone bases could rupture completely. This loosening prevents implants from being placed and can cause a more severe bone defect due to resorption, infection, or sequestration of the bone fragment. Another problem is how to achieve primary stability of the implants as anchorage is obtained in the most apical portion of the bone\textsuperscript{6} and conventional implants have points that...
distance the vestibular and lingual plates even further.

To reduce the chance of complete bone fracture and prevent other complications, the technique can be performed in 2 surgical stages. In the first stage, a full-thickness flap is elevated to perform the horizontal and vertical osteotomies. After suturing, a 30-day period of waiting for repair must follow in order to allow the flap to join to the bone again. In the second surgical procedure, expansion and implant placement are performed with a small access through the ridge. In the event that the bone fragment completely loosens from its base, this minimal access leaves it still attached to the periosteum, reducing the chances of necrosis and bone sequestration.5

When BEC is successfully performed and there are no complications, the advantages include less morbidity and diminished rehabilitation time in comparison with block grafts, as the block grafts are normally surgically applied at least 5 months before implant placement, thus increasing treatment time. Furthermore, when the graft is autogenous, intervention is required in the donor area to remove the graft, increasing the cost and possibility of morbidity and complications.7

BEC is indicated for single or multiple edentulous areas in the anterior and posterior regions of the maxilla and in the posterior regions of the mandible. Moreover, several prosthetic treatment modalities may be used on implants placed in the expansion areas, such as multiple or single fixed dentures, those of the protocol type, and overdentures.8,9 All these authors have shown that there are possibilities of rehabilitation using the BEC technique.

The space created by BEC can be filled with different biomaterials, such as bovine bone, hydroxyapatite, and autogenous bone, or it can simply be left without any filling. The use of combined expansion and guided bone regeneration techniques is recommended by some authors, but others do not favor the use of barriers because there is a chance that the membrane will collapse, facilitating the occurrence of infection and higher morbidity to the patient.5,6,9

As a prerequisite for performing this technique, the literature has shown that the remaining bone must be 7 to 10 mm high and at least 4 mm thick, and there must be a minimum of 1 mm of medullary bone between the vestibular and lingual cortical as measured by panoramic radiography and computerized tomography techniques.5,8,9 By means of BEC, gains of 4 to 9 mm in bone thickness on atrophic ridges may be obtained, and the survival rates of implants range from 91% to 97.3%.6

With the purpose of reducing the occurrence of complications and seeking the best possible results by means of BEC, the aim of this study was to present a modified BEC technique, performed in 2 surgical stages, using narrow pointed implants to improve anchorage and implant stabilization associated with the overlapped flap and to achieve better coaptation of the wound. A clinical case will be presented to demonstrate the technique.

**Clinical Presentation**

The patient, a 41-year-old woman in good general health, sought the Implant Dentistry Service of the Specialization Course at the Paulista University with the desire to replace missing teeth 14, 15, and 16. After a clinical exam, the clinicians planned to place implants in the region of teeth 14 and 16 associated with a fixed denture to replace the lost crowns, if there was a sufficient amount of bone. A computerized tomography exam of the region was performed, in which it was possible to verify that there was an insufficient amount of bone to place regular diameter implants (Figure 1). To enable implant placement, a 2-stage bone expansion surgery was planned (TSBES).

A trapezium-shaped flap was performed with an incision in the center of the ridge and relaxing incisions involving the teeth adjacent to the area to be expanded. After flap separation, 3 osteotomies were performed with the use of a straight handpiece fitted with bur 701. The first osteotomy was performed in the center of the ridge with a depth of 8 mm (Figure 2a), and 2 distal and mesial osteotomies were performed in the vertical direction with depths of at least 2 mm and heights 3 mm shorter than the lengths of the implants planned (Figure 2b). After the osteotomies, the flap was repositioned and sutured.

One month later, the second surgery was performed. A partial-thickness flap was elevated from the palatal side. For the palatal approach this split-thickness flap widens at its apical and until it touches the alveolar bone. Two vertical incisions were performed on the inner flap, which facilitate
flap elevation. The remaining connective tissue and epithelium covering both sides of the edentulous alveolar ridge is elevated to expose the bone edentulous ridge\(^{10}\) (Figures 3a and b).

The plates were separated with a 1-mm thick chisel, up to 2 mm short of the desired implant length (Figure 4). After separation, expanders up to 2.6 mm in diameter were used, with a depth equal to the size of the implant indicated (Figure 5). When this was done, the narrow pointed implants were placed (Figure 6). After the implants were placed, the space between the bone plates was filled with bovine bone (Figures 7a and b), and the flap was sutured (Figure 8).

Six months later, a tomography was performed to confirm the expansion, and the implants were then reopened (Figure 9). The implants loaded over 1 month. Six months after the denture was placed, the patient reported no pain or discomfort (Figure 10a). At a postoperative follow-up of 30 months stability of peri-implant bone tissue was observed (Figure 10b).

**Discussion**

The great advantage of TSBES in comparison with BEC is the reduced risk of complications occurring as a result of loosening of the bone fragment. With TSBES, in case of complete fracture, the fragment may remain attached to the periosteum, and it can remain viable through the nutrition coming from the periosteum.

The implants used in this study had narrow points, allowing easy insertion into locations where submilling was performed. Moreover, they are indicated for bone of lower density.\(^{11,12}\) The advantage of these implants, in comparison with conventional implants, is that because they have a
spear-shaped point, as they approach the most apical portion of the expansion, they cause less risk of fractures because their tapered points fit better in the fissure caused by expansion, generating less stress in the bone plate.

Performing the overlapped flap after bone expansion allows the expanded area to be better covered and more protected. Although the palatine plate may be slightly exposed while the flap is being distanced, it appears to be more robust than the vestibular plate, and in our experience, it is rarely fractured. Moreover, this type of flap ensures that there is no deficiency of keratinized tissue adjacent to the implants, and it maintains the position of the mucogingival junction and the bottom of the vestibule; flap closure in BEC often requires coronal displacement. This makes reopening surgery more complex, as a tissue gingival graft may be needed to improve the condition of the keratinized tissue around the implants and eventually deepen the bottom of the vestibule.\(^\text{5,10,13}\)

The TSBES discussed here is a modification of BEC that may be used for solving cases of deficient thickness in the maxilla. Although the risks of complete fracture and loosening of the vestibular bone plate are minimal, the technique is difficult to perform. The dental professional must have experience in mucogingival surgery because of the difficulty of performing the overlapped flap in the second surgical stage. Furthermore, it is necessary to have experience in placing implants without a flap, because the small distance makes it difficult to determine the correct position of the implant to be installed.

**Conclusions**

Within the limitations of this case report, it was concluded that the modified bone expansion technique can be considered an efficient procedure to minimize complications of bone fragment loosening, loss of adequate implant stabilization, and inadequate closing of the surgical wound associated with the conventional bone expansion technique. However, we believe further studies will be necessary to completely validate the benefits of the proposed technique.

**Abbreviations**

BEC: bone expansion with corticotome
TSBES: two-stage bone expansion surgery
REFERENCES


